

Wound care during the COVID-19 pandemic: improving outcomes through the integration of telemedicine

Abstract: COVID-19 is highly contagious and its rapid spread burdens the healthcare system. As the number of confirmed cases goes up, the shortage of medical resources has become a challenge. To avoid the collapse of the healthcare system during the fight with COVID-19, all healthcare workers, including wound care practitioners, should adapt to new roles and use any appropriate

methods available to slow the spread of the virus. Integrating telemedicine into wound care during the outbreak helps maintain social distancing, preserve personal protective equipment and medical resources, and eliminate unnecessary exposure for both vulnerable patients and high-risk healthcare workers.

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At the end of 2019, an outbreak of pneumonia caused by a novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was identified in Wuhan, China.^{1,2} WHO announced the disease as the coronavirus disease 2019 (COVID-19), which rapidly progressed from a public health emergency of international concern to a pandemic event.³

COVID-19 is highly contagious and spreads through human-to-human transmission with a relatively long incubation period (median time of six days).⁴ During the incubation period, the carriers are asymptomatic and can infect other people without knowing it.⁴ Since the beginning of the pandemic, there have been over 102.1 million reported cases of COVID-19 and over 2.2 million deaths globally.⁵

Healthcare systems are under stress

This pandemic is a global threat which puts tremendous stress on healthcare systems. Italy is facing a shortage of PPE and healthcare workers, a lack of intensive care unit (ICU) beds and ventilators, and doctors and nurses have been instructed to triage patients for ICU treatments based on chances of survival.⁶ Even in the US, palliative care liberalisation is occurring to make ICU beds more

available. Other regions have seen similar issues as the number of COVID-19 cases continues to increase worldwide.

As the number of cases in the US continues to grow, US hospitals are reporting shortages of ventilators needed by critically ill patients and personal protective equipment (PPE) for medical staff.⁷ The importance of flattening the curve of new infections cannot be emphasised enough.

With the goal of flattening the curve of new infections, political leaders are encouraging social distancing, closure of non-essential businesses, cancellation of social gatherings and limiting activities outside the home.^{8,9} Additionally, government and regulators are also mandating rescheduling or cancelling all non-essential medical services and elective surgeries to eliminate the exposure to COVID-19 for both healthcare workers and patients, and to reserve medical resources as more confirmed COVID-19 patients present to hospitals needing medical care.^{10,11}

Wound care patients and healthcare workers are at high risk

During this time of the crisis, all aspects of the healthcare system must collaborate and adapt to accommodate the sudden changes when fighting with the novel coronavirus. Wound care services could be misclassified as elective care, but without regular wound care, patients are at risk of developing wound infections, increasing the risk for limb loss and for loss of life.¹²⁻¹⁴ In the management of wound care patients, the goal of care at the current time should be providing the patients with adequate care to prevent their wounds from deteriorating and limiting unnecessary in-person visits to minimise the exposure to the virus for both patients and healthcare workers. It must be noted that at the current time, the wound care community must recognise that its goal in

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treating wounds is maintenance of the status quo, not the improvement and closure of the wound.

The presence of non-healing wounds is a culmination of multiple underlying medical problems. Most wound care patients have multiple comorbidities, such as diabetes, hypertension and kidney disease, which categorise them as members of the high-risk population who could face severe consequences if they have COVID-19.

Emami et al.¹⁵ performed a systemic review and meta-analysis to identify the prevalence of underlying disease in hospitalised patients with COVID-19. The study found diabetes, hypertension, cardiovascular diseases, smoking, chronic obstructive pulmonary disease (COPD), malignancy, and chronic kidney disease were among the most common underlying conditions in hospitalised patients with COVID-19, respectively.¹⁵ Guan et al.¹⁶ analysed the data of 1590 laboratory-confirmed hospitalised patients from 575 hospitals across mainland China. They evaluated the risk of serious outcomes in patients with COVID-19 by stratifying the comorbidity status. Of the patients, 399 (25.1%) reported having at least one comorbidity and 130 (8.2%) patients reported having two or more comorbidities. Patients with COPD, diabetes, hypertension and malignancy were at risk of reaching the composite endpoints, which were admission to ICU, utilisation of invasive ventilator, or death. Overall, the patients with any comorbidity yielded poorer clinical outcomes than those without. A greater number of comorbidities also correlated with poorer clinical outcomes.¹⁶ Therefore, due to their underlying comorbidities, wound care patients would fall into the group of patients who are at high risk for worse outcomes if exposed to COVID-19. Any efforts to decrease their exposure to the virus is of utmost importance.

While taking care of patients, healthcare workers expose themselves to COVID-19. China's National Health Commission revealed that >3300 healthcare workers had been infected as early as March 2019, and local media reported at least 22 deaths by the end of the February that same year.¹⁷ In Italy, 20% of frontline healthcare workers were infected. Healthcare workers are under a lot of physical and mental stress worrying about losing patients and colleagues, acquiring the virus and passing it along to their families.¹⁷

The task of protecting both high-risk patients and healthcare workers by minimising the exposure to the virus is essential. For wound care patients, reducing the number of visits to wound care centres to decrease exposure, while maintaining the essential care needed for wound healing and preventing wound deterioration is a fine balance that wound care practitioners should strive to achieve. A triaging system related to where patients can receive care can be implemented.

A triaging system for lower extremity wounds

Rogers et al.¹⁴ suggested a triage system for lower-extremity wounds and diabetic foot problems during

the pandemic. They categorised patients with Infectious Disease Society of America (IDSA) severe and some moderate infections, gas gangrene, sepsis and acute limb-threatening ischaemia as critical, in priority group one. These patients should get care in the hospital setting. Patients with IDSA mild and some moderate infections include osteomyelitis, chronic limb ischaemia, dry gangrene, worsening foot ulcers, and active Charcot foot, which are categorised to be in serious condition, in priority group two. These patients should get care in an outpatient clinic, office-based laboratory, surgery centre or podiatry office. In priority group three, patients with improving foot ulcers and inactive Charcot foot (not yet in stable footwear) can receive care in a podiatry office, at home and through telemedicine. In priority group four, stable patients, who represent 94% of patients with diabetes with foot wounds, can be treated at home or through telemedicine. They are the patients with uncomplicated venous leg ulcers (VLU), healed foot wounds or amputations, and inactive Charcot (in stable footwear).¹⁴ Based on this triage system, many of the non-critical cases can be dealt with outside of the hospital and clinic settings by providing more support at the patient's home by visiting nurses and physicians, and through telemedicine.

Being at the epicentre of the COVID-19 pandemic in New York, new wound management protocols have been implemented at our institutions. Before the COVID-19 pandemic, lower extremity wounds consisting of arterial, venous, diabetic and neuropathic ulcerations generally followed a pattern of management and treatment depending on the patient location whether inpatient or outpatient. Since early March, a number of changes in inpatient and outpatient wound care protocols have been employed.

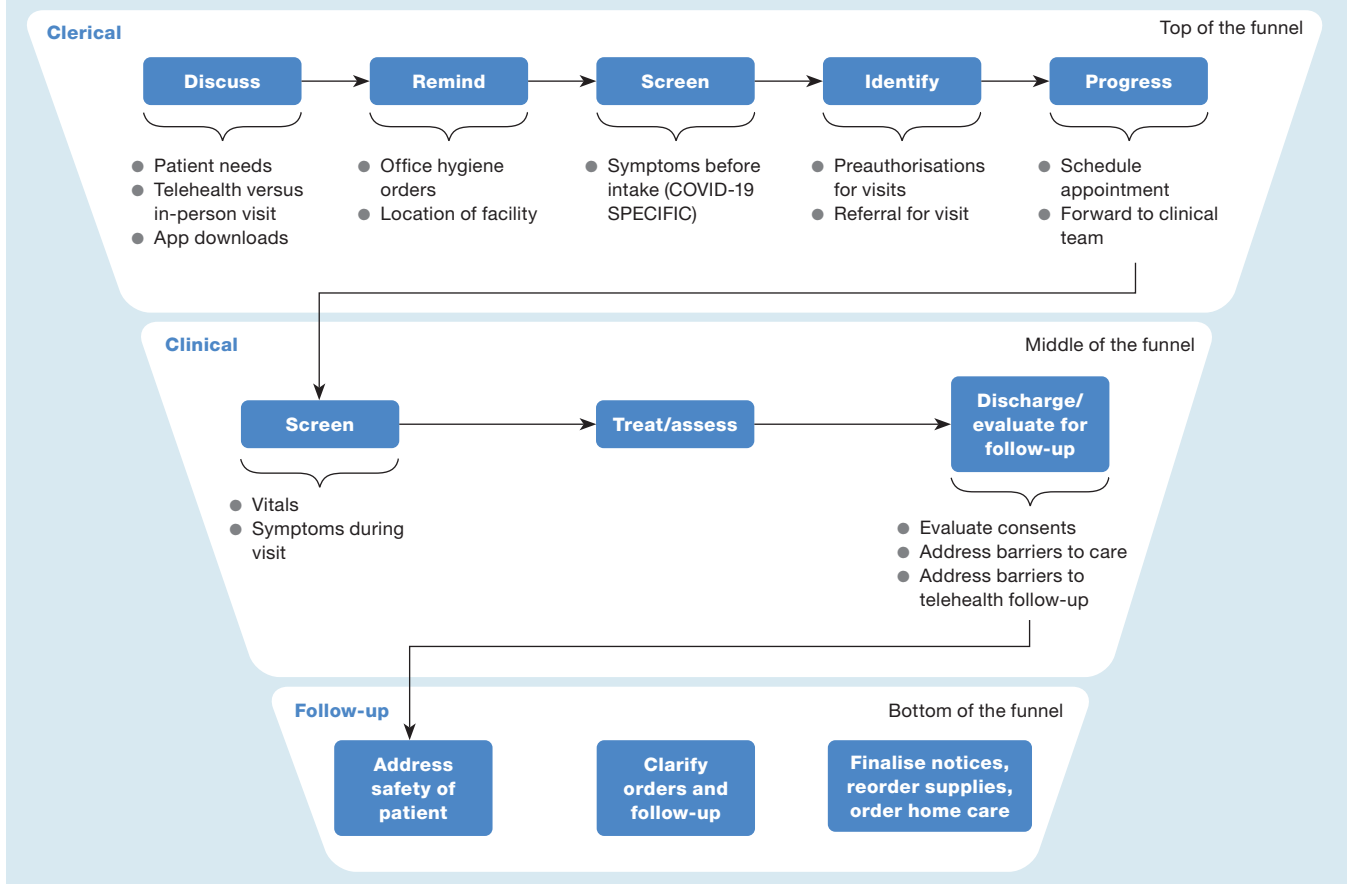
Inpatient management: before the COVID-19 pandemic

Inpatient lower extremity wounds were assessed by a vascular surgeon or podiatrist. After a physical examination, a proper arterial insufficiency work-up was performed. If the patient warranted revascularisation, the patient underwent this procedure and, if necessary, subsequent debridement of the wound. The patient was then discharged with further follow-up for wound surveillance and vascular procedure.

Inpatient management: after the COVID-19 pandemic

With the advent of the pandemic, no elective surgeries were performed between 15 March and 15 May 2020 as mandated by the New York State Governor, although they resumed thereafter. If a patient presents with a lower extremity arterial ulceration without evidence of acute ischaemia or limb-threatening infection, including wet gangrene, surgical revascularisation is deferred. This algorithm is applied to concomitant diabetic ulcerations as well as other lower extremity ulcerations with concomitant arterial insufficiency. Local wound care regimen is initiated as the patients are discharged and

Fig 1. General workflow visualisation. For patients presenting for in-person visit and patients seen through telehealth, a coordinated effort is required between the clerical and clinical portions of the wound care team



step-by-step instructions for follow-up, either in person or via telemedicine, is provided. VLU and lymphoedema with ulcerations follow a similar pattern. An assessment is undertaken while the patient is in hospital. After physical examination, debridement and compression therapy are performed at the bedside when necessary. Further vascular work-up is deferred to outpatient follow-up.

It must be noted that arranging for this altered care algorithm requires increased discharge planning resources and coordination of care with home healthcare agencies and home medical equipment companies. In addition, added office or wound care centre resources are required to follow up with these home care providers to make sure that these more complex home care plans are followed.

Outpatient management: before the COVID-19 pandemic Patients with arterial, venous, lymphatic, and diabetic ulcerations were assessed in face-to-face appointments. This enabled the vascular surgeon or podiatrist to perform a physical examination to determine whether subsequent vascular testing was needed. Vascular testing such as ankle-brachial index (ABI) and pulse volume recording was performed in a vascular

laboratory. Wound supplies were prescribed via the durable medical equipment supplier. Homecare orders were prescribed to those patients that were considered homebound. Homecare visits did not occur during the scheduled office visit day. For those patients who were unable to receive homecare orders for nursing dressing change of lower extremity wounds, weekly visits to the office were scheduled.

Outpatient management: after the COVID-19 pandemic Doctors, nurses and clerks work together to provide a streamlined process for patients treated through telehealth and in-person when required (Fig 1). Face-to-face encounters can be initiated via a telehealth platform when the patient is capable and eligible. Zoom (Zoom Video Communications, US), Skype (Microsoft Inc., US), Facetime (Apple Inc., US), as well as hospital-based platforms are used including Amwell (previously known as American Well, US) and the EPIC telemedicine platform (EPIC, US). All platforms allow an instant encounter with the patient, where they can discuss their history and concerns during the virtual appointment. Homecare services and wound supplies can then be initiated. During the pandemic, all patients are considered homebound. Thus, all patients qualify

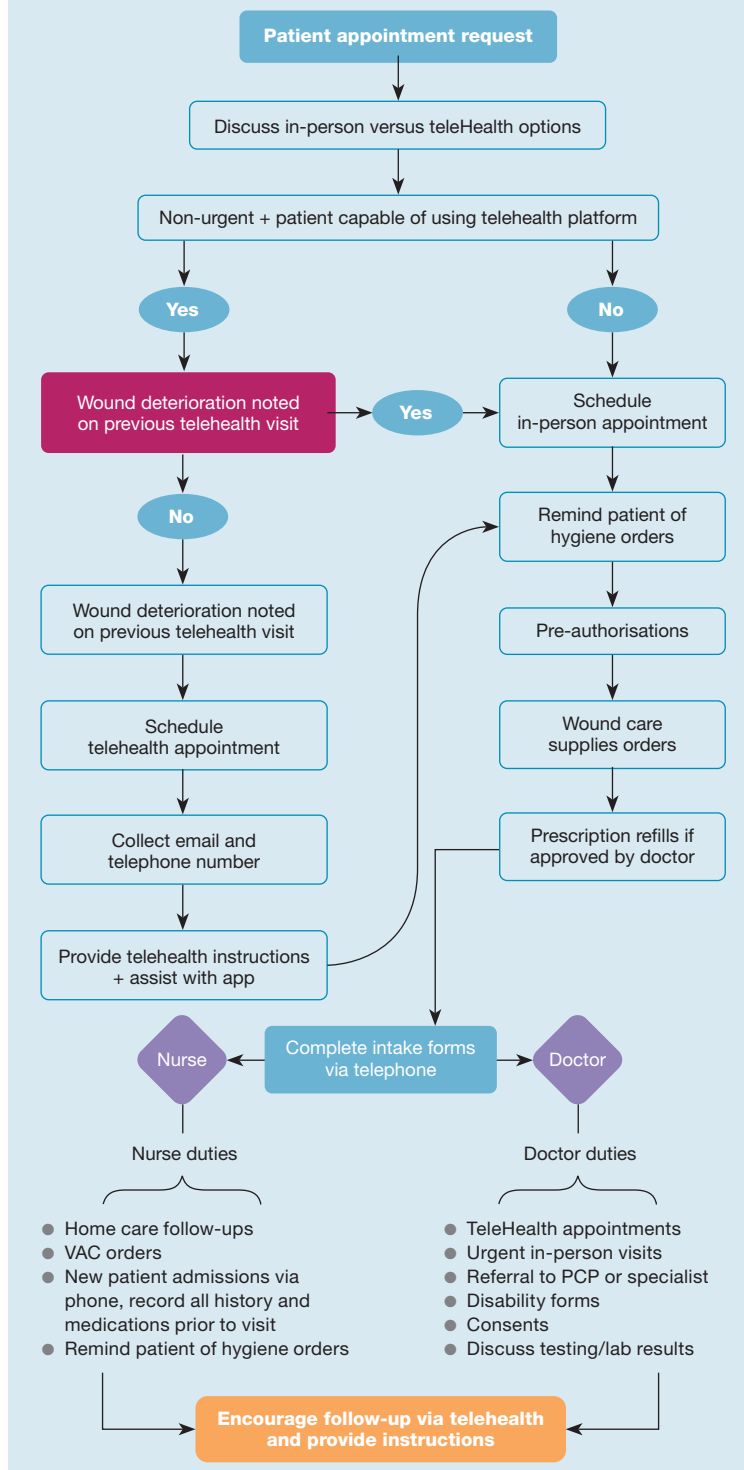
for homecare services which include social services and physical therapy. Social services provide 'at home' meals to those eligible. Homecare visits can now be arranged during the same time as the virtual patient encounter with the doctor. All nurses have access to telehealth communication. Nurses have access to additional information that surgeons cannot obtain such as the vitals, physical examination, wound measurements and progress of the wound. Homecare nurses enable the surgeons to direct the care to the patient and reorder any supplies that are needed. Patients can be rescheduled for a weekly telehealth visit with the nurse. Patients with deterioration of wound progress are directed back to the office to further evaluation (Fig 2). Deterioration of lower extremity wound progress and need for evaluation and intervention is determined based on doctor and nurse discretion and the following criteria: 1—increasing necrotic tissue; 2—appearance of any signs of infection; 3—failure to show signs of healing in a timely manner, and 4—appearance of excessive fibrotic tissue that requires sharp debridement.

The frequency of wound care visits

In terms of determining the frequency of wound care visits, it is hard to provide a clear and detailed guideline for various types of wounds. Insights can be found from previous studies. Carter and Fife¹⁸ evaluated 39,750 wounds associated with 17,849 patients seen in 115 clinics. Diabetic foot ulcers (DFUs) seen at a frequency of 7.5 times or more per four weeks heal faster than the wounds seen at intervals of two weeks or less. More frequent wound care visits enable the practitioners to identify multiple issues that can slow down the healing process including: patient adherence issues, challenges that might affect adherence to the treatment, early signs of infection, whether home nursing services are carried out appropriately, and whether the wound needs debridement. Increased patient interaction also reduces social isolation, which has a positive influence on patients. The authors recommend that patients be seen at least once every two weeks, preferably more often.¹⁸ Warriner et al.¹⁹ found similar results that DFUs and VLU's closing over twice as fast on average in the weekly compared with the every-other-week group.¹⁹ Wilcox et al.²⁰ recommended more frequent debridement as the DFUs heal faster with weekly or higher-frequency debridement.

Wound care specialists play a crucial role in healing lower extremity ulcerations. Ideally, the more frequent the wound care visit is the better the result we can achieve. Other factors, such as the severity of the wound, the progression of the wound, and if the visiting nurse and the patient can take care of the wound appropriately at home must be taken into consideration. During a pandemic, such as the COVID-19 pandemic, the primary goal of care is to provide the patient with sufficient support while eliminating unnecessary exposure for the patients and health care workers to the virus. Increasing

Fig 2. Patient flow at our wound care institution in the outpatient setting during the COVID-19 pandemic. Telehealth is used with all capable, non-urgent patients with no recent deterioration of wounds



the implementation of telemedicine and shifting care to a patient's home plays a crucial role in shifting the medical care away from clinic settings, where patients can be exposed to the virus, to the safety of their homes.

Telemedicine and remote care services

Telemedicine care for patients with diabetes has been used for over two decades.²¹ It has already been widely used in many countries to provide cost-effective and less resource-demanding medical care. The first conceptual framework for telemedicine implementation during outbreaks was published in 2015.²²

Tchero et al.²³ conducted a systematic literature review and meta-analysis on telemedicine in diabetic foot care, in which they focused on two controlled trials.²³ Wilbright et al.²⁴ included 140 patients who were treated for neuropathic forefoot ulcerations. Of the patients, 22 received telemedicine, whereas 120 patients received traditional care. After a follow-up of 12 weeks, the patients in the telemedicine group as well as the control group had statistically similar healing time. Complete ulcer healing was found in 75% of the test patients and in 81% of the control group.²⁴ Rasmussen et al.²⁵ conducted a study on 374 patients with DFU. Of these, 193 received telemedicine that consisted of two teleconsultations and one traditional care at an outpatient clinic while the remaining 181 patients received three consultations at an outpatient clinic. After a one year follow-up period, both groups had statistically similar rates of amputations, however, the telemedicine patients experienced a significantly higher mortality rate without clear underlying reasons. No adverse events were reported associated with the telemedicine group with 72% of the telemedicine group showing complete ulcer healing while 73% of the controls showed complete ulcer healing.²⁵

The telemedicine system implemented in the included studies in the systemic review²³ was often used by a trained nurse who collects data and takes digital images of the wound. The information collected by the nurse was then sent to the physician for decision-making. The collected data included questions about quality of life, such as nutrition, movement and pain levels, as well as patient satisfaction with the treatment. Afterwards, the wound care specialist would send treatment advice to the nurse and the patient.²³ The majority of the studies in the systemic review²³ reported that supplementing outpatient clinic visits with telemedicine consultations increased the frequency of complete healing and the healing rate of DFUs, as well as reduced frequency of limb amputation. Patients in several studies reported satisfaction with telemedicine use.^{26–28}

Telemedicine was shown to be helpful in previous outbreaks, including severe acute respiratory syndrome- associated coronavirus (SARS- CoV), Middle East respiratory syndrome coronavirus (MERS- CoV), Ebola and Zika viruses.^{29,30} During the COVID-19 pandemic, telemedicine, especially video consultation, has been promoted to reduce the risk of transmissions. However, most countries lack a regulatory framework

to authorise, integrate and reimburse the service. A call to adopt the necessary regulatory changes supporting wide implementation of telemedicine during the COVID-19 pandemic for countries without the integrated service was made by Ohannessian et al.²²

In the US, the Center for Medicare & Medicaid Services (CMS) has broadened access to Medicare telehealth services to enable beneficiaries to receive care from healthcare workers without having to travel with an aim of preventing further spread of COVID-19. There are three main types of virtual services that the healthcare providers can offer to the Medicare beneficiaries: Medicare telehealth visits, virtual check-ins and e-visits.³¹

When conducting Medicare telehealth visits, the provider must establish an interactive audio and video telecommunication system that permits real-time communications with the patient at home. These visits are considered the same as in-person visits and are paid at the same rate as in-person visits. The patients can get the care in any healthcare facility and in their home, and the patients can be new or established. Virtual check-ins entail a brief communication service between established Medicare patients and practitioners over a telephone, through video or image, secure text messaging, email, or use of a patient portal to avoid unnecessary trips to the doctor's office. Established Medicare patients can also use e-visits, which means patients may have non-face-to-face patient-initiated communications with doctors using online patient portals.³¹

The Health and Human Services Office for Civil Rights exercise enforcement discretion and waive penalties for Health Insurance Portability and Accountability Act (HIPAA) violations against health care workers that serve patients in good faith. Providers are able to communicate with patients through commonly used technologies, such as FaceTime or Skype, during the COVID-19 public health emergency.³¹ Many states have temporarily relaxed licensure requirements related to physicians licensed in another state, and retired or clinically inactive physicians.³² Detailed information regarding licensing requirements in response to COVID-19 can be found at the Federation of State Medical Boards.³³ Healthcare workers should include their legal and billing teams as early in the process as possible, and check with their malpractice insurance carrier to ensure coverage for the telehealth service provided.³⁴

Conclusion

The world is facing a difficult time fighting with COVID-19. This highly contagious and fast-spreading virus has a long incubation period, which makes it difficult to contain. Wound care specialists should be prepared and act on shifting care away from the clinical settings to patients' homes when appropriate, to preserve medical resources and minimise the exposure to the virus for patients and practitioners.³⁵

Implementing telemedicine and using more home visiting services can help achieve the goal.

However, one of the lessons learned is to implement this change in treatment paradigm as soon as a pandemic is anticipated. Helping a patient and their care providers, including family, set up the appropriate telemedicine platform(s) and download the appropriate applications in the wound care centre, office, hospital or clinic can be much more helpful than trying to walk them through it at home. In addition, setting up the home care services earlier than anticipated can help the home care agencies stratify and triage patients appropriately. Unlike other diseases, a highly infectious

pandemic will significantly deplete home care providers, and may inhibit access, even to family members.

Furthermore, multiple studies have pointed to the efficacy of telemedicine in improving wound care patients' outcomes as well as the high patient satisfaction rates with these services.^{23,26–28} With the lessons learned from this pandemic it is clear that the use of telemedicine in wound care should be increased and optimised to improve wound care for patients not only during the COVID-19 pandemic, but also after spread of this virus is successfully contained and a return to a sense of normalcy is achieved. **JWC**